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ABSTRACT

On-the-job training (OJT) is the most frequently used training method in industry. This OJT is mostly unstructured. While off-job-site training (OJST) should prepare for or supplement OJT, coordination between OJT and OJST is often poor. Advantages of OJT include its low cost, realistic nature, and motivating force. However, it is usually unplanned and must take a secondary place to production. Most books on industrial training describe a four-step method of conducting OJT. Although military OJT is more structured, it has many of the same problems as civilian OJT. Social learning theory, which has been developed to describe and predict how people learn from observation of models, can yield a number of rules for optimal training conditions. However, use of social learning theory as a technique for training and modifying behavior has been studied mostly outside of industrial settings. Social learning theory has been applied to industry in two ways: to teach managers to deal more effectively with human relations problems and to predict which subordinates will imitate the behavior of their supervisors. Social learning theory concepts and training methods appear feasible for application to OJT. (Twenty training principles derived from the theory, for use in structured OJT, are presented.) (HH)

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On-the-Job Training and Social Learning Theory: A Literature Review

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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FOREWORD

This report was prepared by the Human Resources Research Organization (HumRRO). It discusses the current use of On-the-Job Training (OJT) in industry, the application of Social Learning Theory to OJT and the implications thereof.

The report is a part of a project under the U.S. Bureau of Mines Contract No. H030828. Mr. W. Wiehagen of the Bureau of Mines Research Center at Bruceton, Pennsylvania is the Technical Project Officer. The research was conducted in the Educational and Training Systems Division of HumRRO in Alexandria, Virginia, where Dr. Robert J. Seidel is the Division Director. Mr. Paul E. Loustaunau was the Project Director. The principal author was Dr. Thurlow R. Wilson, who was assisted by Dr. Joseph Olmstead in the area of industrial training and by Mr. Robert C. Trexler in the area of OJT.

The research and development effort in compiling this report occurred in December 1979 through May 1980.

James W. Singleton
President
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ON-THE-JOB TRAINING AND SOCIAL LEARNING THEORY: A LITERATURE REVIEW

SUMMARY

OJT in Industry

The most frequently used training method in industry is OJT. Mostly this OJT is unstructured, that is, lacking a training plan designed to develop specific skills and lacking a trainer. Structured OJT is most often found with employers with very large work forces. Off Job Site Training (OJST) should prepare for or supplement OJT. In practice the coordination between OJT and OJST is often poor.

OJT is commonly thought to have certain advantages; OJT is low cost, realistic, and can motivate those employees who are turned off by classroom training. The weaknesses of OJT is that it is usually unplanned. Also it is seldom possible to maximize training on the job and production; OJT must necessarily take a secondary position to production.

Most books on industrial training describe a four-step method of conducting OJT.

Before instruction: make a job breakdown, make a course outline, have equipment and materials ready.

Step 1. Preparation: put learner at ease; find out what he already knows about the job, get learner interested in the job.

Step 2. Presentation: tell, show and illustrate one important step at a time; stress each key point, instruct clearly, completely and patiently, but no more than he can master.

Step 3. Application: have him do the job and correct errors; have him do the job again as he explains each key point; have him do the job over until you know he knows.

Step 4. Follow-up: put him on his own; check frequently, praise good work, reinstruct to correct poor work.

Studies of apprenticeship reveal the following difficulties in many apprenticeship programs:

- the trainee is treated as a helper or semi-skilled laborer.
- the trainee fails to rotate between all the tasks of the job.

- classroom training (OJST) is poorly correlated to OJT.
- the demands of production receive most or all of the trainer's attention and the needs of the trainee are neglected.
- trainers lack knowledge or skill regarding instructional methods.
- training material is inappropriate--outdated, inaccurate, written above reading level of the trainee.
- completion of training is based on exposure time rather than demonstrated proficiency.
- the training plan is not based on an accurate job analysis.

Military OJT is highly structured compared to OJT commonly found in industry. The most advanced training technology will be found in use in military OJT. Nevertheless, military OJT systems have many of the same problems as civilian OJT, such as difficulties coordinating between classroom and job proficiency training, unsuitable training materials, failure of the trainee to get experience in all the aspects of the job.

Investigations comparing the results of different methods of conducting OJT found:

- for a semi-skilled factory job structured training resulted in a significant reduction of training time compared to unstructured training (4.6 hours compared to 16.2 hours).
- for machinist apprentices, training can be accomplished in a fraction of the allotted training time if the training follows a task outline and trainees move to a new task when they have demonstrated mastery of a task.

The federally-funded CETA program includes OJT. Workers who are disadvantaged in education and job experience are hired in entry level jobs, and employers are reimbursed for training costs. Reports on CETA OJT give little or no information on what job training is actually furnished by employers. Apparently many employers receiving the OJT subsidies believe that they are not obligated to provide structured job training in return for the payment.

Social Learning Theory

Social learning theory has been developed in the last 15 years primarily to describe and predict how people learn from observation of models. Learning from models has been shown to be more efficient than trial and error learning under many conditions. According to social learning theory, observational learning is controlled by processes of attention, retention, and reproduction. Rewards operate to affect performance of behavior not learning. In addition to motivating behavior by directly rewarding it, a person may perform behavior that he observes another is rewarded for (extrinsic reward), and he may learn to reward himself for appropriate behavior.

From social learning theory, a number of rules can be derived for optimal training conditions. Twenty statements about conditions for effective training are given to illustrate the application of social learning theory to industrial training. For example: "When modeling a task, give the learner a verbal model to guide performance. The best verbal models will give rules for the responses of the task, but will be as simple as possible and easy to remember." "The trainee is most likely to learn to reward himself for a good job performance if he comes to feel that the work he is performing is very important to himself and to the company and that he has significant control of the work outcomes."

The use of modeling as a technique for training and modifying behavior has been studied mostly outside of industrial settings. Researchers on modeling find that modeling can be used successfully to help people make therapeutic behavior changes (such as overcoming fears and becoming more self-assertive) and for teaching interpersonal skills such as skills involved in counseling, interviewing and child management. It is usually found that significantly more learning occurs when modeling is added to other training methods (usually instruction and rehearsal) than if these training methods are used without modeling.

Social learning theory has been applied to industry in two ways: a training method based on social learning theory has been used to teach managers to deal more effectively with human relations problems occurring on the job, and social learning theory has been used to predict which subordinates will imitate the behavior of their supervisors.

A number of companies have trained their supervisors to deal more effectively with various interpersonal job problems (such as motivating the poor performer, overcoming resistance to change, handling a discrimination complaint) by means of Interaction Modeling. In Interaction Modeling training the supervisor trainees watch a film of supervisors interacting effectively with employees in a problem situation. The trainees practice the behaviors modeled using role playing. Social reinforcement is provided when their behavior becomes similar to the model. Transfer of training is encouraged in a number of ways. Most importantly, the managers in charge of the supervisors are trained in Interaction Modeling and encourage application of Interaction Modeling concepts on the job. Several investigations have demonstrated that the supervisors do learn the skills taught by Interaction Modeling and use them on the job. Furthermore, significant increases in productivity have been observed in work groups after their supervisors were trained by Interaction Modeling.

Whether or not a foreman will imitate the leadership behavior of his boss can be predicted to some extent by propositions derived from social learning theory. An investigation showed that, as predicted from social learning theory, subordinates who perceived their bosses as high in competence, success and power to reward were most likely to report a leadership style which was similar to the style reported by their superiors. The relationships between superior-subordinate behavior similarity and subordinate perceptions were found to be significantly more positive among lower self-esteem workers than among higher self-esteem workers.

Implications of the findings for on-the-job training were discussed. Since structured on-the-job training is more effective and more efficient than the informal on-the-job training currently most prevalent in industry and government, the increased use of structured programs is warranted. Structured programs may be generally applicable for jobs that are common to many industries or companies. This general applicability makes it feasible for government agencies, trade associations, etc. to develop structured programs which can be widely disseminated and adapted with only minimal modifications to suit local conditions.

Social Learning Theory concepts and training methods were judged to be quite feasible for application to on-the-job training. A set of 20 training principles were derived from the literature and their relevance for use in structured on-the-job training programs was discussed.

INTRODUCTION

This literature review is prepared as part of Bureau of Mines sponsored "Improvement of OJT Procedures Through Modeling, Imitative and Other Learning Techniques" under Contract No. H0385106.

The project has the objective of utilizing principles derived from Social Learning Theory to design and demonstrate an effective on-the-job training (OJT) program for the coal mining industry. Task 3 of the Phase I plan was a review of the relevant literature. The literature review is divided into two parts: (1) industrial OJT and (2) Social Learning Theory and its application to industrial OJT.

PART I. INDUSTRIAL OJT

Scope of Review and Sources

Scope of the Review of OJT Literature

The publications examined included general discussions of the principles of OJT and descriptions and analyses of OJT in industry for skilled and semi-skilled workers. Analyses of OJT as part of apprenticeship training were included as were studies on OJT of skilled jobs within the military services.

Sources of Literature Reviewed

The literature reviewed was obtained from the following sources:

- Bibliography on OJT prepared by the Defense Documentation Center.
- A search of all OJT references from ERIC, Government Report Index, and Psychological Abstracts.
- A search of George Washington University and U.S. Department of Labor libraries.
- Inquiries to officials within the Office of Research and Development of the Employment and Training Administration of the U.S. Department of Labor.
- An inquiry to the Bureau of Mines library in Washington, D.C. (No reports on mining OJT were found.)
- The references on OJT cited in the articles and books obtained from the above search methods.

Definitions Used in Literature Review

Before discussing research about On-The-Job Training (OJT) we need to define the terms "OJT," "Off-Production-Site Training (OPST)," "structured OJT," and "unstructured OJT."

OJT--a training process that takes place primarily on the job during actual production operations. OJT may include instruction given off the production site.

OPST--a training process that usually takes place in a training facility such as a classroom or especially equipped site used primarily for training either on or off the firm's premises. This facility may be operated by the company or by other organizations such as a technical institute, community college, or university. OPST is sometimes referred to as "related training."

Structured OJT--OJT that has an identifiable plan designed to develop a worker's specific skill or level of competence and involves the active presence of an instructor or trainer during the training process. A teaching machine or some other programmed self-learning device may be substituted for a human instructor. OJT which is not structured consists of "learning by doing" or "picking it up." Fellow employees or supervisors may provide instruction on an unsystematic basis.

The Use of OJT in Industry

Frequency of Use of OJT

OJT was reported to be the most frequently used training method in a survey of 112 Minneapolis/St. Paul firms (39). On the average, the firms indicated that they "usually" trained workers with OJT. A 1963 Department of Labor survey of workers found the most frequent way that industrial workers reported that they had learned their job was by OJT.

Use of Structured and Unstructured OJT

Wenig and Wolansky (46), after examining available data on industrial training methods, concluded that most training of skilled and semi-skilled industrial workers (excluding apprenticeship) is informal on the production line with instruction given by the foreman or another worker. Perlman (26), in a study of OJT in 150 Milwaukee firms (132 of them manufacturing firms), found that while all of these firms reported that they used OJT, 96 percent had only informal or unstructured programs. Perlman (26, p. 7) reports, "The typical pattern of company training followed by most of the firms in the study is not one of on-the-job training, if that term implies teaching a worker new broad skills at the plant site. Rather, it is a form of instruction that can perhaps be described by the term 'as-you-work training'. This expression implies that when an opening for a job requiring some skill arises and is to be filled by a promoted worker, the process of learning and practice (training) does not preceed the assignment but begins with the worker's taking his new place in the production process."

A national survey of training in 14 highly skilled metal working occupations (23) found that only 15 percent of the establishment in metal working industries provided structured occupational training--OJT and/or OPST--including apprenticeships.

The four metal working industries surveyed were fabricated metal products, machinery except electrical, electrical machinery, and transportation equipment. Approximately 2,800 firms were included in the national survey. Fourteen occupations, which account for a significant proportion of employment among the highly skilled manual occupations, were selected for the survey (including electrician, machinist, millwright, tool and die maker, pipefitter, and welder).

On-The-Job Training and Off-Production-Site Training

Structured training can be given on or off the job site. In the survey of metal working industries (23) it was found that two-thirds of the enrollments in structured training were in training on the job.

In the survey of metal working industries, the extent of training on the job was related to the occupation. The only occupation with more training off the job than on the job was that of welder. A number of occupations, however, were found to have over 90 percent of structured training enrollments on the job. These included crane operator, electroplater, millwright, pattern maker, tool and die maker, and filer-grinder-buffer.

The purpose and content of the training for metal workers was found to be associated with whether the training was given on or off the job. (See Table 1 below, "Subject Matter of Structured Training: By Purpose and Type of Training.") Note that no subject matter is trained exclusively on or off the job. However, since OJT is defined as training that takes place primarily on the job, OJT could include some OPST or classroom training.

An investigation of related or OPST in three trades (machinist, electrician, operating engineer) provides an in-depth look at the role of related training (34). Data was gathered from apprentices, journeymen, apprentice coordinators and others by personal interviews and/or mail questionnaires. The general goal of the related instruction for these apprentices was found to be to make an all-round craftsman, that is to provide the breadth and flexibility to handle unusual situations and use new technologies. Other purposes of related instruction were found to be; to substitute for training not possible on the job, to promote identification with the trade, to give advance preparation for OJT, and to review previous education.

We conclude that OPST in industry may have important, perhaps indispensible, functions in preparing for or supplementing OJT. Any analysis of an OJT system must necessarily examine an OPST system as well.

TABLE 1. - Subject Matter of Structured Training: by Purpose and Type of Training
[From Neary (23)]

(Establishments reporting subject matter as a percent of all establishments providing structured training in selected occupations, 1974)

Subject Matter	Qualifying Training		Skill Improvement Training	
	On-the-job training	Off-production-site-training	On-the-job training	Off-production-site-training
All establishments in selected industries[1]	100.0	100.0	100.0	100.0
Production and quality control	42.9	25.1	73.7	22.1
Care and use of tools and equipment	91.6	49.9	85.3	54.3
Trade mathematics	53.7	42.8	26.0	69.8
Blueprint reading/ drafting	72.3	53.7	78.7	74.4
Layout and planning procedures	50.9	42.0	28.1	40.6
Machine operation	83.7	51.2	81.0	80.0
Estimating labor and material requirements	14.2	5.2	11.6	14.7
Safety procedures	82.1	39.2	58.8	38.5
Preventive maintenance, repair and inspection	50.7	15.3	45.0	36.3
Work attitudes and habits	65.6	29.4	68.3	17.2
Leadership training	7.9	3.0	10.3	4.2
Communication skills	12.3	10.6	13.7	6.2
Other subject matter	3.2	17.2	3.9	5.2

[1]Fabricated metal products; machinery, except electrical; electrical machinery; and transportation equipment.

NOTE: All columns are nonadditive; many establishments listed more than one job skill taught in structured occupational training programs.

Training by Large Versus Small Employers

One characteristic which is repeatedly found to be strongly related to the kind of training that an employer carries out is the size of the employer's work force (5, 23, 24, 39, 46). It is reasonable to assume that in general small employers do not have the training resources that a larger employer has and that the costs of developing a structured training course are much higher per trainee for the small employer than the large employer.

Differences between small and large employers are clearly described by Neary's investigation of occupational training in metal working industries (23).

The proportion of establishments offering structured training (OJT or OPST) were found to be higher for the larger employers; less than 20 percent of companies with fewer than 250 employees reported structured training while 50 percent of those with 1,000 or more employees stated that they conducted structured training.

The kind of structured training by large employers and small employers differs. Among firms giving structured training, firms with 1,000 or more employees compared to firms with smaller work forces are much more likely to:

provide training for the instructor

have a training budget allocation

have classrooms or equipped training rooms

determine content of training by in-plant analysis, by plant management, or by consultants

evaluate training program periodically.

In program evaluation, large firms as well as small firms make frequent use of ratings and other feedback from work supervisors. The evaluation by the large firm, however, is much more likely than evaluation by the small company to include some testing of the trainees to determine degree of skill which has been acquired by training.

Strengths and Limitations of OJT

When OJT was rated by a group of industrial trainers along with a number of other training methods on some 34 criteria, OJT received the highest total rating (43). It was seen by the trainers as a low cost, highly realistic training method which can generate high levels of student motivation. Transfer of training is not a difficulty as with most other instruction methods. It was recognized that OJT is not the most effective method for instructing in theory; such instruction is best done in OPST.

A major weakness of OJT stems from the fact that it is usually carried out in an unstructured form. "Unfortunately, most OJT programs are not planned and, thus, don't work well. Too often, practicality is the main reason that this form of training is chosen. It is cheap and easy to implement without any planning at all. The simple instruction to any employee 'help John learn the job' fully implements the training program. The entire instruction process is placed in the hands of an individual who may or may not be capable of performing the job and who probably considers the entire procedure an imposition on his time." (12, p. 142).

A problem to be overcome with any OJT is to administer and evaluate training effectively during production. In industrial work situations it is seldom possible to maximize training and production at the same time (21). OJT must necessarily take a secondary position to production and production may limit OJT in certain ways.

- The optimum sequence of training tasks cannot be arranged without interferring with on-going work.

- Some tasks as encountered on-the-job are too complex, fast-paced, or pressured to give an effective demonstration or practice opportunity for the trainee.

- The performance of trainees using expensive equipment may be such an economic loss that it may be difficult to find opportunities for trainees to practice on the equipment. Trainees may then be assigned to semi-skilled duties which don't interfere with the on-going work but fail to provide the planned training opportunities (19).

- If the instructor is a production worker, attention to production demands can interfere with the instructor's attention to training.

- Production records have distinct limitations as indices of employee performance. Generally no diagnostic measures are available from OJT unless special provisions are made (21).

The cost of an OJT program may or may not be favorable when compared to an OPST program. Instructor costs are higher in OJT. The OJT instructor has few trainees while the OPST instructor can handle many more trainees. The costs of OJT in an unstructured form are low, but the costs of structured OJT include costs of course development, administration and evaluation. Further, the costs assessed against an OJT program must include losses in production or damage to production equipment caused by involving novices in production. Gant points out "the actual cost of doing dangerous training on the job is high when the costs of life, property, and personal service are explicitly included. Lowering the risks associated with job performance has a substantial history of economic rather than humanitarian causes." (10, p. 9).

Assessing the costs and benefits of large OJT systems is not simple. Sophisticated ecometic models have been developed to analyze the costs involved in large complex OJT systems such as those in the military services (10).

OJT for Disadvantaged Workers

OJT has been advocated as a training method to use with disadvantaged workers (hardcore, long-term unemployed, minority, educationally deprived, etc.) who may be disenchanted with classroom types of training (4, 20).

Through the federally-funded CETA program many disadvantaged workers have obtained entry level jobs with plans for OJT with some form of reimbursement to employers to offset the costs of training. Reports on OJT under CETA provide little or no information on what job training is actually provided by employers. For example, in a current Department of Labor publication dealing with CETA models of OJT, the job training given by the employer is discussed in only one sentence of the monograph (4). The focus of the monograph is on obtaining the OJT positions and selecting and preparing the applicant for them. One Department of Labor official commented that for CETA OJT generally "the job is the training"--that CETA OJT is of the unstructured "as-you-work" variety of training. A union training specialist characterized CETA OJT as "a bribe to employers to hire disadvantaged workers." One study of OJT subsidies (under Manpower Development and Training Act, a forerunner of CETA) to small employers in New Haven, Connecticut indicated that a sizeable number of the employers (22 out of 95) viewed the subsidies as payments for which they did nothing in return (4).

Skill Advancement, Inc. (SAI) developed and demonstrated a training approach for upgrading low wage (primarily minority) workers which was labeled "High Intensity Training" or HIT (11). The report on HIT is instructive because unlike most reports dealing with job training of disadvantaged workers, it provides a detailed description of the training development, training plans, training materials, and results. Also the report suggests why skill training alone is unlikely to be effective in upgrading these workers; it indicates the arrangements in addition to provision of skill training which may be necessary for effective upgrading.

SAI assumed that certain problems tend to confine the disadvantaged worker to low occupational status: functional illiteracy--often accompanied by a history of educational, economic and occupational failures; prejudice on and off the job; the worker's frequent apathy and indifference; the worker's basic distrust of management's reasons and objectives in offering him training; management's skepticism of the latent abilities and capabilities of minority group workers.

High intensity training included training of low skill employees on and off the job. "High Intensity Training programs...were designed to help the low-skill worker become occupationally mobile; to give him greater control over his own destiny in relation to his home, his family, and his economic needs. At the same time, they were designed to involve the private sector in training and upgrading its own employees." (11, p. 3-13). High intensity training included these features:

- Programs were conducted within the plant setting among selected low-skill employees of the organization.

- Training agreements between the employer and SAI ensured the upgrading of trainees to better jobs, with a change of job title and an 8 to 10 percent wage increase upon completion of training.

- Most training programs were designed for completion with a total of 40 hours of classroom instruction. During the five-week course the trainee practiced the newly trained skills on the job one day each week.

- Curricula were developed specifically to meet the particular manpower needs of the individual organization. A trainer spent from two to three weeks in the plant analyzing the function of the target job in order to prepare a practical, realistic training curriculum.

- The trainer printed and distributed training manuals covering the complete curriculum on a day-to-day basis to all trainees and to management.

- Curriculum content was designed to raise the worker's level of aspiration; to build the self-esteem, confidence and motivation necessary to encourage him to go beyond the job for which he was being trained.

- High Intensity Training programs were designed to develop the technical skills and the human relations skills of the low-wage worker.

- SAI trained a company employee to carry on subsequent HIT programs for the organization.

- Management furnished the SAI trainer with weekly work evaluations for each trainee (on forms provided by SAI).

- At the conclusion of the program SAI awarded certificates of completion to trainees at a formal "graduation ceremony."

During the first year of the project, SAI designed and implemented 51 HIT programs in 46 organizations. The organizations included plastic manufacturers, hospitals, and a restaurant. The jobs for which upgrading training was given consisted of supervisory jobs (e.g., assistant foremen, team leader) and technical skill jobs (e.g., extrusion operator, medical coder, ward secretary).

The key aspect of the trainer role in the plant was felt to be "unfreezing the negative attitudes and perceptions of supervisors and management towards their low-skill workers." The involvement of supervisors and other skilled personnel in the HIT program is one way in which this "unfreezing" process was started. Other ways included making the supervisors feel more secure, and pointing up areas in which more skilled subordinates tend to improve the supervisors' status in the organizations. Apparent improvement in the attitudes, behavior, and skill of the trainees further help to correct negative or stereotypical perceptions.

The Four Steps of Job Instruction Training

During the war years a four-step method for conducting OJT, called Job Instruction Training (JIT), was taught to many industrial supervisors and trainers as part of the effort to produce an increasing number of skilled workers for war industry needs. The four steps are: preparation, presentation, application, and follow-up. Virtually every book dealing with industrial training includes a description of the four-step method as the method for conducting OJT (e.g., 18, 25, 28, 41, 44). While the four steps of JIT have been universally adopted by industrial training specialists as a model for OJT, our literature search failed to find a single study of the effect of training industrial trainers in principles of JIT. Further, although we did not find research analyzing the effort of the various components of JIT, most of the basic assumptions behind JIT receive general support from research on training.

The rules of JIT can be summarized as follows:

Getting Ready to Instruct

1. Make a job breakdown
2. Make a course outline
3. Have the right equipment and material ready.
4. Be sure the workplace is properly arranged.

Instruction

Step 1. Preparation

- a. Put learner at ease
- b. State the job and find out what he already knows about it
- c. Get him interested in learning the job
- d. Put the learner in the correct position

Step 2. Presentation

- a. Tell, show and illustrate one important step at a time
- b. Stress each key point
- c. Instruct clearly, completely, and patiently, but no more than he can master

Step 3. Application

- a. Have him do the job, correct errors
- b. Have him do the job again as he explains each key point to you
- c. Ask questions to make sure he understands
- d. Have him do the job over until you know he knows

Step 4. Follow-Up

a. Put him on his own

b. Ask questions on key points

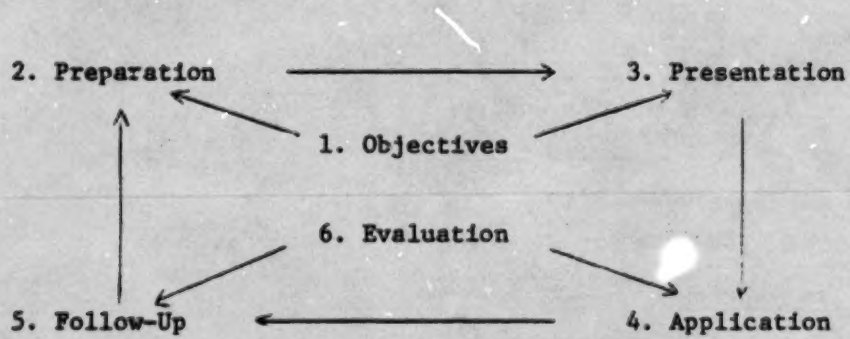
c. Check frequently, praise good work, reinstruct to correct poor work

The exposition of JIT by various authors varies somewhat in what is included under each step and how each rule is expressed.

Expansion of the Job Instruction Training Model

Ford (9) argues that "four steps are no longer enough." To the steps of preparation, presentation, application, and follow-up he adds two other components--objectives and evaluation--recognizing that these components are implied by most of the expositions of Job Instruction Training.

The expanded JIT is diagramed as follows:



The first step is the determination of objectives. An instructional objective is a "statement describing what the learner is expected to do in terms that describe behavior." An objective "describes what the learner will be doing when demonstrating his achievement and how one will know when he is doing it." (9, p. 30). A description of the desired terminal behavior: identifies the overall behavioral act, defines the important conditions under which the behavior is to occur, and defines the criterion of acceptable performance. Objectives serve as a foundation for the entire instructional process.

Evaluation is listed as the final step in the model but actually it is a continual function. "All through the learning situation, the instructor should reflect on and evaluate each element in terms of the objectives. Evaluation is usually thought of as evaluating the student. In this model it's used to evaluate the entire learning process and as a self-evaluation for the instructor." (9, p. 33-34).

Apprentice Training

A system of providing OJT and OPST for skilled workers is by apprenticeship. Much of the research dealing with OJT for skilled workers relates to apprenticeship and most has been carried out under the sponsorship of the U.S. Department of Labor's Office of Apprenticeship Research.

A description of the typical apprenticeship program is given by Oriel (24):

> Once accepted on a program, the apprentice is indentured for the duration of his apprenticeship--most commonly 4,000 to 8,000 hours, or two to four years depending on the trade involved. He or she is usually required to take a total of 576 hours of related instruction (144 hours per year). In industry, the apprentice usually receives shop instruction by working with a journeyman or an advanced apprentice on regular work assignments that come through the shop. In most of the more formalized programs the specific shop tasks to be learned and the number of hours an apprentice is to spend on each phase of his shop training is specified in detail. While many companies, especially the larger ones, make an attempt to follow these specific guidelines, the demands of production and other forces in the organization often mitigate against strict adherence to the training specifications.
>
> Detailed lists of related instruction courses to be taken by apprentices in each trade are also characteristic of the more formalized, better-run apprentice programs. And the number of course or credit hours required is usually spelled out in detail. Apprentices may--and most often do--take related instruction courses in local public schools. Courses may, however, be offered on company premises or by correspondence. The typical method of instruction is the traditional combination of textbook/workbook and instructor. (24, pp. 2-3).

A number of criticisms have been made of the method of conducting OJT under apprenticeship. In a survey of former apprentices in New York state of the 9,000 individuals completing questionnaires (19), one-third of them wrote in comments or suggestions regarding OJT. Their suggestions are summarized in Table 2. It can be assumed that these write-in suggestions underrepresent the percent of apprentices experiencing these problems in their training. In a study of apprentices conducted by Drew (6) apprentices were questioned directly as to whether they were rotated between assignments and 40 percent reported that they were hardly ever or never deliberately rotated with the result that they did not have sufficient variety in work assignments. Among New York state apprentices only 8 percent volunteered write-in comments about the lack of job rotation (19).

We quote some representative suggestions given by New York apprentices concerning OJT (19, pp. 17-20).

1. A man who dropped out of the tool and die apprenticeship program after 4 months: "I had no training whatsoever in anything. I did only

TABLE 2. - Comments and Suggestions on How to Improve On-The-Job Training by Former Apprentices
[From Maier and Loeb (19)]

Suggestion	Percent of Total Suggestions
The apprentice should not be used primarily as cheap labor on production; emphasis should be on quality of work, not on speed	15%
The apprentice should not be used primarily as an errand boy or laborer	11%
Give the apprentice an opportunity to rotate within the shop or from company to company so that he will receive all-round training and learn about different machines, processes and operations	26%
Make sure that the shop has adequate equipment to give all-round and up-to-date training	1%
Provide more on-job training	19%
Make journeymen available to answer questions instead of being too busy, uncooperative, or afraid that apprentices will take their jobs	3%
Provide qualified instructor whose only function is to supervise and train	7%
Provide up-to-date instruction	3%
Instructor should check on progress periodically to make certain that the apprentice understands what he is doing and is given an opportunity to ask questions	11%
There should be more technical training	2%
Apprentices should be encouraged to develop their own methods of work	1%

assembly line work although I had been trained in a college program on how to operate such complicated machinery as the turret lathe and especially computer-operated machines."

2. A journeyman who completed his bricklayer apprenticeship in 1968 wrote: "I would not use the apprentice in excess for such work as washing down brickwork and making cuts with the saw for journeymen. The apprentice is used for this work because it is cheaper for the contractor...I have known of cases where apprentices have never laid a brick until their last 6 months of apprentice training. As a result, when they become journeymen they could not hold a job."

3. A man who dropped out of the program for roofers after 1-1/2 years of training: "You are paid 60 percent of the base pay because you are supposed to be training on the job, but all you do is unskilled odd jobs. If you are going to learn, you have to pick it up yourself. I think it is the foreman's responsibility to see that the man is given a chance to learn on the job and to teach him as much as he can. The foreman should be required to keep a daily log on the progress of the apprentice and the man given a test on these things."

4. A sheetmetal contractor who had completed his apprenticeship: "No time was spent in on-job training. You worked with a mechanic as a helper and learned from observation. No one was allowed to spend time teaching."

5. A journeyman tool and die maker: "I think there should be an apprentice supervisor--that is, one man to oversee and understand the problems that apprentices have. Also, he would set up and maintain the apprentice schedule to make sure each apprentice is getting the best possible training from the best qualified individuals."

A task analysis of six apprenticeable trades in a large midwestern manufacturing company was carried out by Training Methods Inc. (36). Conclusions from the TMI study reinforce the suggestions given by New York state apprentices:

> By far the majority of an apprentice's instruction comes from journeymen... He spends nearly two-thirds of his training time working with and ostensibly being trained by journeymen... That journeymen, who are essentially skilled craftsmen with little or no training in how to instruct others, are qualified or competent to carry such an educational burden is called into serious question not only by apprentices but also by many journeymen. Their comments reflect several conditions which seem to prevail:
>
> 1. Journeymen are too busy to give apprentices the type and quality of shop instruction they need.
>
> 2. In many cases they may not be capable of providing the needed training. While they may be expert in their trade, they are not necessarily good instructors.

3. Running throughout the comments received from both the survey and the interviews is a theme reminiscent of the traditional apprentice-journeyman relationship. Apprentices are seen as helpers, not as trainees--as the low man on the totem pole whose function is to do the dirty work and run the errands. Further, journeymen think of themselves as craftsmen, not trainers. Some are even unwilling to assume responsibility for training.

The apprentices need and want more effective on-the-job instruction. The study seems to indicate, however, that in reality they often work alone and learn by trial and error. Even when they do work with journeymen, their role is often that of helper, not learner. The quality of the instruction they get apparently varies widely from one journeyman to another and the study data seem to indicate that much of the instruction they get is of the type where they are passively watching rather than actively participating (24, pp. 21-22).

Additional major deficiencies that are pointed our for apprenticeship OJT concern job analyses on which the instruction is planned, the nature of the instructional objectives and the coordination between the OJT and the related instruction.

Every recent investigator of apprentice training methods has commented on the fact that the programs studied were either based on job analyses that were helplessly out of date or they had been developed based on someone else's outdated job analysis. In the TMI study we found apprentices taking complete courses designed to develop knowledge and skills (such as slide rule) that were never used on the job. This kind of armchair curriculum development--based on what has been the traditional practice--is characteristic of apprentice programs (24, p. 12).

The objectives of virtually every apprentice training program in the U.S. are stated not in terms of the measurable performance expected of apprentices upon completion of training, but rather, in terms of the number of hours they must spend in each phase of shop and related instruction. Further these objectives have been determined, for the most part on an arbitrary, rationale basis, without benefit of recent job analyses. The primary emphasis--is on a single measure of time (i.e., 4,000 or 8,000 hours) for all apprentices; measured performance appears to play a secondary role...in practice, uniform performance standards are either lacking or are used informally and with great variability (24, p. 10).

Many investigators have noted a lack of coordination between OJT and OPST (related instruction) (6, 24, 32, 33). "The lack of temporal coordination between classroom and OJT prompted some to refer to this aspect of the program as 'unrelated training.' This lack of coordination was

by far the single most prevalent complaint. All apprentices follow the same route through their related training, but each follows his own unique path through his shop training. In some cases one never quite catches up to or matches the other. For this reason many apprentices and journeymen question the value of the entire related training program" (24, p. 20).

Drew (6) from his study of apprenticeship described an optimum training system for apprentices. We quote the recommendations relevant to OJT:

> --Trade analysis techniques are used to identify course content whether for a national, regional or single-employer curriculum.
>
> --Presentation of subject matter is the best manner to assure learning and provide for successive levels of achievement.
>
> --Administrative officer controls curriculum through planning guide, and keeps records of what, when, where, and to whom content was taught.
>
> --National training materials are developed that can be modified according to local needs.
>
> --Training materials for the instructor are also developed.
>
> --Instructional material includes nontechnical subject matter, such as work planning, as well as technical subject matter.
>
> --In on-the-job training, adequate job rotation is provided through jobs that provide a challenge.
>
> --On-the-job training is correlated with related instruction.
>
> --On-the-job training job sites are suitable for training; production demands are not too heavy for training purposes and there is an adequate ratio of journeymen to apprentices to assure proper attention to training.
>
> --Provision is made for determining achievement levels of trainees in on-the-job training.
>
> --Timing of theory and skill training is coordinated in instruction.
>
> --Modern teaching tools and techniques are used in all phases of instruction.
>
> --Trainee is monitored by single individual throughout all phases of training, and adequate record of his progress and achievement is kept.
>
> --Method and frequency of evaluation should meet with trainee's satisfaction.
>
> --Teaching is geared to the interests and abilities of the trainees.
>
> --Instructors are selected on basis of grade competence and teaching ability.
>
> --Instructor recruitment is aided by adequate recognition through economic reward and through licensing and/or certification.
>
> --Training for instructor occurs both prior to and during teaching.
>
> --Provision is made for periodic review of program content with view toward updating. (6, Vol. 1, p. 20-22).

A Systems Approach to Training by Private Industry

Some large employers have developed training of workers based on a systems approach, as the survey of metal working industries indicates (23). Brief descriptions of such training programs have been published but we were unable to find a single published investigation of such a private industry training system including OJT.

The Bell Telephone training program is an example of a comprehensive and well-structured training system. The eight elements of the Bell training program are:

"1. A known entry level for employees...

2. Foreman training on employee development...

3. Classroom training plan. AT&T had 139 standardized training courses with instructional material, text material, instructors' guides, and exercises geared to specific job requirements.

4. OJT programs. The workers' foreman conducted OJT. During this training period the trainee also used a self-instructional training package.

5. Foreman development...

6. Opportunity for self development...

7. Continuous planning for new courses...

8. Evaluation Plans. AT&T evaluated its training program from beginning to end. It looked at all items which may have had an influence upon training methods." (46, p. 31-32).

OJT in the Military Services

The bulk of published investigations and reports on OJT concern (a) apprenticeship and (b) OJT in the military services. A Defense Documentation bibliography on OJT lists some 40 references. We consider that apprenticeship OJT is more relevant to training conditions in coal mines than is military OJT. Accordingly, we will deal with military OJT more concisely than our review of apprenticeship OJT.

In addition to the differences between military and civilian occupations there are some important differences between military and civilian OJT programs (31):

--Military OJT programs involve many more people than civilian OJT programs. For example for the Air Force it is estimated that the total number of man-years invested in OJT is approximately 10% of the authorized enlisted strength of the Air Force at a given time.

--The requirement for men who can quickly replace each other in the event of casualties demand an unusual emphasis upon standardization of training.

--Rapid turnover among experienced trainers requires detailed documentation of training procedures.

--Sophisticated planning of military training becomes economically feasible when there are extremely large groups of trainees. For example, if there are 10,000 people being trained in the same specialty every year, a very slight improvement in performance or in training can justify a sophisticated data gathering as regards the best way to design the course of instruction.

Publications on military OJT fall into three categories: specific training courses involving OJT, (b) construction of OJT training aids and training materials, (c) management of OJT training systems.

Publications describing and analyzing particular OJT training courses comprise the largest number of references on military OJT. The sources described in these publications include: air craft mechanic, truck driver, anti-submarine warfare, submarine personnel, food service, air intelligence, electronic equipment operation and maintenance. (Because these publications on specific military training courses have little relevance to mining OJT we do not cite the references for them.) Publications dealing with construction of training materials for OJT deal with computer aided instruction (22), job performance aids (3), analysis of readability of training materials (8), development of correspondence instruction (15) and identifying OJT content when surrogate jobs are used in training (37). Reports concerning the management of military OJT systems include system analyses (40, 31) and the analysis of costs and benefits involved in OJT systems (2, 7, 17, 29, 30, 45).

We present a brief description of the OJT system of the Air Force and the problems involved in operating this system (31). Each of the military services has somewhat differently organized and administered programs of OJT.

For the Air Force, as for other military services, OJT is part of a larger training system which includes formal school training. Three training priorities for formal school training are distinguished:

A. Highly technical skills that must be taught in school;

B. Technical skills that can be taught either in school or by OJT;

C. Semi-technical skills that are taught only by OJT.

"School quotas tend to be the dominant factor in decisions as to whether personnel in Category specialties will be trained by OJT or in school. When there are more Category B trainees than the schools can handle, the surplus is usually sent out to learn by OJT" (31, p. 11).

The Air Force OJT has two channels: job knowledge fundamentals and hands-on-proficiency. Job knowledge is learned from correspondence courses conducted by the Extension Course Institute of the Air Training Command. When a student finishes studying an assigned book, he completes an open book test which is computer scored by ECI to provide a percentage score and a list of the questions missed. Using the course study guide the trainee may identify sections of the text related to each of the incorrectly answered questions and review this material. The end of course examination is a closed book test taken in the presence of a local testing official and scored by ECI.

Training for job proficiency is chiefly the responsibility of the trainee's supervisor. The Air Force classification manual for enlisted occupations or specialties defines what personnel in an Air Force specialty are supposed to do. The requirements in the Air Force manual are translated into a task breakdown and performance level expectations are assigned to yield a Specialty Training Standard (STS). An actual Air Force job assignment will not correspond exactly to the STS: the actual job may involve fewer tasks and different proficiency levels. The STS is modified for a particular trainee by selecting tasks and proficiency standards to give the Job Proficiency Guide (JPG). The JPG represent a description of the trainee's current job assignment and is used as the guide for proficiency training of that airman. The trainee is considered to have achieved proficiency in that job after both trainee and the supervisor have initialed all of the tasks of the JPG. The supervisor certifies that he has evaluated the trainee's performance in one way or another and has decided the trainee is really qualified to perform each task at the stated level without additional supervision. The trainee certifies he has received training and agrees he is qualified.

The duties and responsibilities for OJT by all the various individuals are spelled out in an Air Force manual (50-23 "On-The-Job Training"). Individuals involved in the OJT program are: major commander, base commander, base personnel OJT unit, squadron OJT administrator, immediate OJT supervisor, trainee, and testing office. For example at each base personnel office the OJT unit is responsible for staff supervision and monitoring of all the OJT programs within units served by the personnel office. They process and approve much of the paperwork associated with OJT programs, provide professional advice to squadron OJT administrators, schedule end-of-course tests, collect statistics regarding the various programs, and audit the OJT program in each squadron to make certain that all programs are administered in accordance with regulations.

A systems analysis of the Air Force OJT system was conducted by Stephenson and Burkett (31) with on-site conference and interviews with hundreds of trainees, supervisors, and administrators. Air Force survey data on OJT was analyzed and some additional survey information was collected and analyzed by the authors. Thirty conclusions were drawn with specific recommendations for program change. We quote some of the major conclusions from the Stephenson and Burkett report (31, pp. 53-65).

> --Information collected from supervisors and trainees about the adequacy of the training materials could be very useful in program planning decisions at headquarters levels.

--Air Force manuals do not provide enough information as regards the conduct of task evaluations during and after proficiency training.

--Inspection teams are putting too much emphasis on details of how records are kept instead of end results.

--There is poor coordination between job knowledge courses and job proficiency training.

--Some trainees who complete proficiency training have not received training in an adequate number of tasks.

--The most serious attitude and motivation problems seem to involve trainees who think they have been misassigned to unpopular specialties.

--Tech Orders and job knowledge courses are written above the reading level of many of those assigned to certain specialties.

--Because of the emphasis on written tests, many of those upgraded get their skill level increases because of their verbal intelligence and their ability to memorize rather than their knowledge of what is really needed to do the job.

--There is too much emphasis on record-keeping procedures.

--Many trainee counseling sessions are either not held at all or they are not very meaningful when they are held.

We suspect that most of the problems revealed by the systems analysis of the Air Force OJT program are those that can be found in operating any large OJT training program.

How do the results of OJT compare to those achieved by formal school training in the Air Force? The findings of studies comparing the graduates of the two training methods (2, 17) failed to show general superiority of technical school training as might have been expected. We conclude that in many instances Air Force OJT can provide training which is the equivalent of school training. Decisions about proper mix of OJT versus formal schooling for various specialties require data not only concerning the quality of trainees of the various training methods but also information on the capacity to train and cost of the training (7).

Investigations Comparing the Results of Different Training Methods

Those analyzing OJT have often claimed that unstructured OJT is a highly inefficient training method compared to structured OJT and that apprenticeship OJT could be greatly shortened and improved. These assertions have been tested in four investigations described below: structured versus unstructured training of a factory job, accelerated compared to usual training of apprentices, a performance based apprenticeship training versus regular apprentice training, and comparison of job performance ratings of those who have learned a trade by different training methods.

Structured Compared to Unstructured Training of a Semi-Skilled Job

Structured was compared to unstructured OJT for a semi-skilled factory job (33). Twenty subjects were trained by each method to operate the extruder machine for manufacturing plastic tubing. The training was conducted in a university laboratory. In this setting it was possible for the experimenter to control the extruder apparatus to create malfunctions and to monitor the workers through concealed closed circuit video equipment. The trainees were recruited from among university students seeking work and from among those applying to public employment offices. Subjects were paid factory wages.

The training procedures were modeled on the structured and unstructured training observed at the Johns-Manville factory. For the unstructured training, the beginning worker was assigned to a fairly inexperienced worker for training. The trainer was to use any training method at his disposal and was also expected to maintain production. For the structured training the experimenter served as trainer. The training consisted of classroom and on-the-job instruction and followed a training manual based on a task analysis of the plastic extruder operator's job. Trainees were considered competent when they could correct experimenter-induced equipment malfunctions and could maintain production.

The findings were the unstructured training method compared to the structured method required a significantly higher training time (16.3 hours compared to 4.6 hours) and resulted in significantly greater production losses (22.0 lbs. versus 5.3 lbs.). There were no significant differences between the costs to train 20 operators under the unstructured method than for the structured method. If a much greater number of workers had been involved the structured method would have shown a cost savings. There was no significant difference in attitudes toward the job among the workers trained by the different methods.

Accelerated Training for Precision Machinist Apprentices

A study of training of precision machinist apprentices (13) found that the present 2,000 first year apprentice OJT could be accomplished in 35 percent of this time. Two randomly assigned groups of apprentices were given training. Group I had accelerated training. The shop owners were told to follow a training outline of tasks and to move the apprentices to the next task as rapidly as possible once learning on a task had been demonstrated. Learning time was the time to perform the task three times to criterion (the criterion was determined by the shop owner). Group II followed the usual training practice; they did not have a predetermined curriculum and recorded time spent on various tasks.

The curriculum for the experimental group students was determined by a survey of owners of companies belonging to the National Tool and Die and Precision Machinists Association and the sequence was established after discussion with training directors.

Proficiency-Based Training

The investigation by Hordman and others (13) showed that it is possible to accomplish the training for machinist apprentices in a considerably shorter time using a curriculum based on an industry survey. Other investigators have shown that further improvements in apprentice training are possible when the training and testing are based on a detailed task analysis.

The Ford Motor Company redesigned the training for apprentices in nine trades using task analysis conducted by outside consultants. "The initial results of the new program, with approximately 200 trainees, indicated that new apprentices could, in an average of 480 hours achieve the same level of shop competence that was achieved in 12 months of training under the old apprenticeship system" (24, p. 104).

Oriel (24) designed and tested a curriculum for first year machinist apprentices starting with a task analysis identifying 170 major tasks for the first year apprentice. Behavioral objectives were identified: 185 for related or classroom instruction and 153 for shop instruction.

Examples of behavioral objectives for related instruction: "trainee will be able to: given several drawings, choose the one which shows the correct way to tighten a vise; tell why a vise should not be tightened with a hammer or a pipe; add and subtract simple fractions as encountered in fractional measurements; given blueprints with incomplete dimensions in both decimal and fractional form, compute the value of the unknown diameter."

Examples of behavioral objectives for shop instruction: "select a cutter appropriate for the job to be done and properly mount it so cutter will easily take a roughing cut and no chatter occurs; clean the lathe and accessories so that workpieces, tools and centers can solidly and safely be mounted, without chatter or wobble."

Based on the behavioral objectives, paper and pencil tests were developed for the related instruction. The tests were used both before and after instruction. The criterion was that 90% of the trainees should score 90 percent or better.

For shop training, 31 audio-visual (A/V) training modules were developed based on the behavioral objectives. These functioned both as training modules and as performance tests. The training modules were self-instructing and self-paced. They provided step-by-step instruction on how to machine metal and also what to do when an error was made or something went wrong. The training modules consisted of a total of 737 35mm slides and 27 sound tapes. The A/V apparatus was mounted on a table or bench and used at the apprentice's machine on the shop floor. Once the apprentice had completed the A/V instruction on a particular machine by completing the performance test satisfactorily, he was given 3 or 4 shop work assignments to apply the skills he had learned. His performance was rated by a supervisor. An average of 37.3 hours was required for the A/V machine shop training.

The planned research design called for 60 apprentices to be trained by the proficiency based method and 60 matched subjects to be trained by the regular method. Because of sharp reductions in the amount of training which occurred during the investigation it was only possible to obtain 29 apprentices and an additional 18 machine shop trainees. No matched control subjects were available. A group of apprentices who had not undergone the proficiency based instruction were used for control and were tested on the related instruction achievement tests. These apprentices had received a total of 187 hours of related instruction compared to 60 hours for the experimental subjects, however, the experimental group scored 30 percent higher on the related instruction final exam.

It was not possible to give machine shop performance tests to the control group of apprentices to compare their performance to the experimental group. Comparisons were made using foremen's ratings. Foremen rated the actual shop performance of the experimental subjects and then gave the rating they believed would have been obtained by the apprentices they supervised in the control group, if these individuals had been administered the same tests. The experimental group, with only 40 hours of training, was rated significantly higher than the control group with an average of 1,200 hours of shop instruction.

Oriel concludes from the investigation: "The data on the performance of the experimental groups and their attitudes toward the experimental program--especially its self-pacing aspect--strongly suggest that the most effective future direction for apprentice training is not to attempt to set new, diminished time standards, but to establish objectively determined and measurable performance standards and to allow training time to vary... It is possible with a systematically organized and administered self-paced program to achieve a uniformly high level of achievement by setting absolute (criterion referenced) performance standards and allowing time to vary. And it is likely that such a program will result in a reduction of average training time." (24, p. vii).

Training Path and Current Job Performance

How does current job performance of tool and die makers relate to the way they learned their trade (training path), whether by OJT, apprenticeship, vocational high school, or just "picking up the trade" by observing co-workers? The investigation of 400 tool and due makers by Horowitz and Herrnstadt (14) found that the form of training as reported by these craftsmen was not associated with current job performance. Job performance was rated by the work supervisor considering accuracy, speed and breadth of skill. These findings appear to be in conflict with the studies just reviewed which indicate more effective training producted by structured, accelerated, or proficiency based training. However, the subjects in the Horowitz and Herrnstadt investigation were an average of 45 years old and had completed their training several years prior to the study. They had a number of years of job experience after completion of training which could wash out the effects of the different training paths.

PART II. SOCIAL LEARNING THEORY

This section of the literature review is concerned with social learning theory and its applications to on-the-job training in industry. For this review social learning theory is defined as the learning theory developed and discussed by Albert Bandura (47). The principles of social learning theory and learning from models are first described. Then a series of rules derived from social learning theory are presented for conducting more effective training. Finally, results of investigations involving social learning theory and learning from models are discussed. Most of these investigations have been conducted outside of industrial settings and have dealt with use of models to produce therapeutic changes in behavior or to teach interpersonal skills. Social learning theory, however, has been applied in an industrial setting to develop a method of training supervisors to deal with interpersonal problems occurring on the job. This training method and its results are examined. A second application of social learning theory to industry, predicting subordinate imitation of supervisor behavior, is described.

Social Learning Theory and Learning from Models

In recent years, learning theorists have turned attention to experiments and hypotheses concerning the special features of human social learning. Accordingly, the processes of learning from examples or models have received much study. Experiments on human subjects have shown that virtually all learning resulting from direct trial and error experience can occur on a vicarious basis through the observation of other people's behavior and the consequences of this behavior (60). Intricate response patterns can be acquired by observing the performance of live or symbolic models (60); emotional and attitudinal responses can be developed by watching the reactions of others undergoing painful or pleasurable experiences (52). Modeling has even been found to be important in teaching autistic children (whose behavior is marked by an extreme nonresponsiveness to social stimuli) (73). Furthermore, the results of human learning investigations have demonstrated that the learning process can be considerably shortened by providing models or even verbal instructions instead of providing rewards for performing appropriate behavior (68). The greater efficacy of training that is possible through use of models is the reason for applying social learning theory to on-the-job training in mining.

Various learning theorists, such as Skinner (76), Mowrer (71), and Miller and Dollard (69), have dealt with human social learning; but we consider the theory developed by Bandura and his students (47, 48, 49) to be the most useful theory to account for observational learning and to provide a basis for improving learning by more effective use of models. This theory has been developed from a large body of studies of observational learning. Accordingly, we shall adopt Bandura's learning theory for our approach to the use of models in on-the-job training and will, henceforth, refer to Bandura's theory as social learning theory.

Social learning theory assumes, under certain conditions to be discussed below, that when a learner is exposed to a model, the stimuli from the model will be coded by the learner into images and/or words, will be retained by the learner, and will be used by the learner to guide performance of the modeled response. In other words, according to social learning theory, what is remembered from the model will be instructions that learners give to themselves when they are attempting to reproduce the modeled behavior.

Social learning theory distinguishes between the factors affecting acquisition and retention of instructions from modeling and those factors influencing performances of a response. Reinforcement (reward) is not necessary for acquisition of the responses but reinforcement does play a major role in performance of the modeled behavior. The nature and degree of observational learning is affected by attentional processes, retention processes, and reproduction processes.

Attentional processes determine whether or not the model behavior will be observed and what aspects of the model will be noted. Attentional processes are controlled by:

- Nature of modeled cues, e.g., novelty, intensity, and discriminability.

- Characteristics of the model, e.g., attractiveness (perceived competence or perceived power).

- Observer characteristics, e.g., emotional state, informational processing capacity, observational habits or sets.

- Incentives for observing, e.g., the learners set to observe activity in order to reproduce the modeled behavior.

Retention of the modeled cues is affected by factors including symbolic coding, rehearsal, and interference by learning similar material. Symbolic coding is found to be the major factor determining retention of the observed cues. Learners often fail to retain cues from a modeled behavior because they lack an appropriate set of coding categories for the modeled behavior (50). Retention is also affected by rehearsal of the modeled behavior; rehearsal may focus attention on overlooked cues of the model and can promote development or discovery of codes for the modeled cues (72). Finally, studies of learning have demonstrated the interference with the retention of learned material by later learning of similar materials (retroactive inhibition).

The learner's success in reproducing the modeled performance depends on attentional and retention processes as well as certain additional factors:

- The nature of response components in the learner's repertoire. The learner may lack certain component responses required for accurate performance.

- Physical or mental limitations of the learner.

- The extent to which the essential cues of the model's responses are visible so that a complete set of instructions can be developed by the learner.

The performance of the modeled behavior depends on the processes of attention, retention, and reproduction discussed above, but also on additional factors:

- The reinforcement (rewards) and costs associated with performing the modeled behavior.

- The similarity of the situation in which the modeled responses are learned and rehearsed and the situation in which the responses are to be performed (55).

Often, performances learned in the classroom do not transfer to performance in complex situations outside the classroom. The performance situation may lack essential cues for the learned response sequence and/or the situation may contain stimuli which arouse responses incompatible with carrying out the modeled behaviors.

According to social learning theory, rewards which affect performance of the modeled behavior may be administered in three different ways. The learner may be rewarded directly for certain behavior. The learner may be motivated to perform a certain behavior after seeing a model rewarded (vicarious reward). The learner may reward himself for carrying out a particular behavior (49).

Self-reinforcement is a process in which individuals give themselves rewards whenever they attain self-prescribed standards. With self-reward, individuals are induced to persist until their performance matches their self-prescribed standards. Furthermore, self-rewards can maintain performance in the absence of external rewards. The individuals evaluate their own behavior using learned standards. For most activities there are no absolute measures of adequacy, and performance is evaluated by comparison to the performance of others. Self-reactions to performance will depend not only on the personal standards used but on how the individual perceives the determinates of the behavior. People take pride in their accomplishment when they ascribe their successes to their own ability and effort. They do not derive much self-satisfaction, however, from behavior they attribute to external factors.

Self-reinforcement responses can be established either by tuition (how others reacted to the behavior) or by modeling. Findings or experiments on children show that children tend to adopt the evaluative standards modeled by others and judge and reinforce their own performances relative to those standards. In experiments on modeling several factors will be adopted:

- People favor reference models similar to their own ability over highly divergent ones whose behavior they can match only through great effort.

- People exposed to conflicting standards (e.g., high standards of the model and low standards of peers) are less likely to adopt high standards than those exposed only to the high standards of the model.

- High standards set by the model are less likely to be adopted by the trainees if the model imposes lenient standards on himself.

Training Principles Based on Social Learning Theory

Using the principles of social learning theory (49) a number of statements about conditions for effective training can be derived. (In our search of the literature we did not find a general discussion of the practical training implications of social learning theory.) The following 20 statements were derived by the author of this review.

1. When teaching a complex, unfamiliar task, break the complex task into subtasks and teach each subtask through modeling.

2. Determine whether each of the subtasks is already within the learner's repertoire. If not, help the learner acquire the subtask through modeling and rehearsal with immediate feedback to the learner on the accuracy of performance. At first, reinforce (praise) approximations of the desired performance, then require closer and closer approximations to the modeled performance. It may be necessary to suppress competing responses temporarily until the desired response is performed accurately.

3. When modeling a task, give the learner a verbal model to guide performance. The best verbal models will give rules for the responses of the task, but will be as simple as possible and easy to remember.

4. While modeling a performance, direct the learner's attention to the essential cues guiding the performance. Make the cues as visible as possible to the learner. For example, it may be necessary, at first, to model the performance in slow motion or with exaggeration of certain responses making the cues apparent.

5. Some important cues directing a performance may be invisible to everyone except the performer. Some means must be developed by the trainer to make these cues apparent to the learner.

6. Especially during initial modeling of a task, the trainer should insure maximum attention by the trainee.

   (a) The training situation should be free of distractions;

   (b) the trainee should not be fatigued or emotionally upset;

   (c) the trainee should know that he will be expected to observe the modeling so that he can then rehearse the modeled response;

   (d) the trainee should be alerted as to what to watch during the demonstration;

   (e) the trainer should know the span of attention of the trainee for learning this material and should keep the modeling and rehearsal well within these time limits.

7. Retention of the modeled response will be facilitated if the learner has memorized verbal instructions to accompany and guide the desired performance.

8. The trainer should minimze the interference of responses previously learned with retention of responses being taught by making the two sets of responses and cues as different and discriminable as possible.

9. While the trainer is modeling specific responses, he will also model particular work values (e.g., safety) whether or not the trainer intends to teach these work values. Trainers need to be aware of their own work values. In some cases, the trainer's work values may need to be modified before he can train effectively.

10. The trainer needs to be certain that the responses being modeled for rehearsal by the trainee do not place demands on the trainee which exceed the trainee's physical or mental capacities.

11. If a learner who does not have all the needed response elements of a model set of responses in this repertoire is required to copy the model, the responses produced will necessarily be distorted. (Like a person imitating a foreign language phrase without having learned the phonemes or basic sounds of the language.) Furthermore, the learner will be unable to correct the distortion of the copied response without special guidance from the trainer even though the response inaccuracies are obvious to the learner.

12. Responses are inhibited by aversive consequences such as negative criticism or ridicule, especially responses which have been little rehearsed.

13. Trainees are likely to carry out behaviors which have been reinforced (rewarded). Behavior will be performed for many times without any reinforcement if, in the past, that behavior has been reinforced and at <u>irregular</u> intervals.

14. Trainers need to be aware of the reinforcers and inhibitors under their control and those being administered by others such as co-workers. Trainers need to administer reinforcers systematically to develop and maintain desired performance. (Many trainers are found to have little awareness of their own use of reinforcers.)

15. Performance of some tasks requires cooperation with other workers (a work team). In this case, after the component subtasks have been learned, it will be necessary to model and rehearse the team as a whole. Too much practice of the subtasks in isolation from the work team will retard or even prevent acquisition of an effective team performance. The essential cues for meshing responses with behavior of other workers need to be learned early in the response acquisition process.

16. It is important to teach the trainee to evaluate and reward or punish his own job performance. First teach the dimensions to use and the standards for judging performance. The trainer should provide a model of evaluating and rewarding (praising) or punishing (voicing criticism) of his own performance. Have the trainee practice evaluating and rewarding or punishing his own performance and the performance of the trainers and others.

17. The trainer should set an example of high performance standards but not standards that are unattainable for the trainee.

18. The trainer should be aware of the impact of work performance standards set by other workers on the trainee. Co-worker standards can support or negate the standards that the trainer is trying to have the trainee adopt. The standards being taught can also be undermined by the trainer's own behavior--if the trainer sets inconsistent work standards for himself and others--e.g., high standards for others and lenient standards for himself.

19. The trainee is most likely to learn to reward himself for good job performance if he comes to feel that the work he is performing is very important to himself and to the company and that he has significant control of the work outcomes.

20. When major malfunctions or errors occur on a complex job, the trainee will tend to deny responsibility--to place blame on factors other than his own job behavior--equipment, work environment, behavior of others. The worker must be trained to recognize his own contribution to the malfunction. The result should be planning to minimize the likelihood of the malfunction in the future. This result is most likely to be achieved if the trainer models problem solving rather than blame fixing.

Therapeutic Applications of Observational Learning

Investigations using videotapes or film modeling for therapeutic purposes were reviewed recently by Thelan and others (81). The reviewers examined some 50 investigations. The behaviors which various investigators attempted to modify included phobias, test anxiety, dental fear, unassertiveness, dating anxiety, and social behavior. A general finding was that in most cases, providing a videotaped model of the desired behavior resulted in more change than the no-treatment condition. In many cases (11 out of 17) the addition of modeling to other training methods (usually rehearsal or instruction) resulted in a significantly greater improvement of behavior.

Based on these researches, it is suggested that certain features of the videotape model are likely to result in greater behavior change: using a coping model (a model who succeeds in producing the desired behavior only after a period of difficulty and uncertainty); confining the modeling episode to a small number of points; using multiple models; and using narration along with the videotape to emphasize the desired behavior.

It is genearlly believed that having a model similar to the observer results in greater behavior change, but investigations fail to uphold this simple generalization. Whether or not model-observer similarity results in greater behavior change depends on certain characteristics of the observer and of the target behavior.

Teaching Interpersonal Skills

The use of modeling in teaching interpersonal skills to adults (excluding therapeutic applications) was the subject of 19 investigations located by search of the last five years of Psychological Abstracts. These investigations and their results are summarized in Table 3. The behaviors being taught included interviewing, counseling and child management skills. In these investigations providing a model usually resulted in more learning than the control condition. Also better results were usually obtained when modeling was combined with role playing and instructions than if these training methods were used without modeling.

Two of these investigations are of special interest because they tested the influence of certain variables in addition to the provision of models. An experiment designed to evaluate and compare methods for training teachers in the use of contingent attention and social approval in the classroom (77) found that modeling plus written instruction resulted in significant greater learning of contingency management skills than written instructions alone. The greatest degree of learning was found for those subjects who were required to be actively attentive during the modeling rather than being passive observers of the modeling. Active attention was secured by requiring the subject in this condition to record observations of teacher-student interactions in code. This investigation supports predictions based on social learning theory concerning the role of attention in observational learning.

An investigation on teaching interview skills (63) found that eye contact during the interview was increased by behavioral methods of teaching (modeling, role playing, and directed feedback) while ability to explain individual skills was more improved by the traditional lecture-discussion method. This research demonstrates that for certain kinds of behavior, provision of a live or videotaped model does not increase learning over verbal instructions and explanation. Certain behaviors can be adequately explained by verbal instructions and no demonstration is needed. In this instance the purely verbal behavior of explaining interviewing skills is taught best in lecture-discussion. However, the research indicates that teaching behavior involving complex interaction between people is generally more successful when videotaped or live demonstration is used as part of the instruction.

Industrial Application of Social Learning Theory and Modeling

Social learning theory has been applied to industry in two ways: a training method based on social learning theory has been used to train managers to deal with human relations problems occurring on the job, and social learning theory has been used to predict which subordinates will imitate the behavior of their supervisor.

Interaction Modeling for Supervisory Training

Social learning theory has been applied to industry in a method for training supervisors in interpersonal skills called Interactive Modeling (54,55,56,61,70,78). Interactive modeling has been used by a number of

Table 3

Results of Studies Using Modeling to Teach Interpersonal Skills

Study	Subjects	Target Behavior	Modeling versus Comparison Treatment
59	parents	child management - time out	Modeling > lecture: written or role play (B)
53	college freshmen	decision making skills	Model + structured teaching = structured teaching (A), (W) decision making
51	ex-offenders	skills in responding to employment interview	Modeling + reinforcement > role play and discussion (B)
45	tutors of elementary and ED students	use of social reinforcers	Modeling + instruction > instruction (B); modeling + instruction + feedback > modeling + instruction (B)
75	welfare care worker	counseling skills	Modeling + role playing > role playing (B) (W)
82	elementary school teachers	skills in using feedback in classroom	Modeling = control (B)
77	teachers	classroom management skills - contingent attention, social approval	Modeling > lecture, modeling + active attention > modeling + passive observation (B)
67	teacher trainees	conflict resolution skills	Modeling + feedback + lecture, role play, discussion > lecture, role play, discussion (B)
83	dental paraprofessionals	interview skills	Modeling > control (B)
66	parents of learning disabled or disturbed children	home token economy program to reduce undesirable behavior	Modeling + instruction > instruction (B)
57	male psychology students	counseling skill	Modeling > didactic (B)
85	female college students	communication skills in small groups	Modeling instructions or reinforcement (B)*
74	graduate students in counseling	counseling skills	Modeling = written instruction (B)
42	counselor trainees	counseling skills	Modeling = didactic (B)
72	graduate students in counseling	counseling skills	No difference between four treatments: modeling, rehearsal, feedback and remediation (B)
79	undergraduate students	reflective responses in interview	Modeling + instruction > modeling or instruction (B)
58	undergraduate college students	vocational	Modeling > control (B)
80	college student mental health paraprofessional	counseling skill	Modeling + role play > lecture, discussion (B)
63	college students	job interview skills	Modeling + role play, feedback > lecture discussion (B), lecture, discussion > modeling, role play; feedback (W)

NOTE: (A) attitude measure; (B) behavioral measure; (W) written test measure; > means significantly better than; = indicates no difference; * means mixed results.

companies for the training of supervisors and has led to measurable improvements in performance and morale of employees.

Four activities make up Interactive Modeling.

1. Modeling. Small groups of supervisor-trainees watch filmed supervisor and employee models interact in effective ways in a problem situation.

2. Role playing. The trainees take part in extensive practice and rehearsal of the specific behaviors demonstrated by the models.

3. Social reinforcement (praise, reward, constructive feedback) is provided by both the trainers and other trainees as their role-play behavior become more and more similar to the models. These three procedures are implemented in such a way that

4. Transfer of training from classroom to job setting is encouraged.

Interaction Modeling has been used for a variety of training needs which include (61):

1. Orienting a new employee;

2. Teaching the job;

3. Motivating the poor performer;

4. Correcting inadequate work quantity;

5. Correcting inadquate work quality;

6. Reducing absenteeism among disadvantaged workers;

7. Reducing turnover among disadvantaged workers;

8. Handling the racial discrimination complaint;

9. Handling the reverse discrimination complaint;

10. Reducing resentment of the female supervisor;

11. Discussing personal work habits with an employee;

12. Discussing formal corrective action with an employee;

13. Giving recognition to the average employee;

14. Overcoming resistance to change;

15. Reducing evaluation resistance;

16. Delegating responsibility;

17. Conducting a performance review.

A videotape of film has been developed to model effective behaviors for resolving each of these problems.

We now describe how each of these four components (modeling, role playing, social reinforcement and transfer of training) are carried out in Interaction Modeling.

Modeling

A five-minute film or videotape depicts how a foreman should handle the problem. A few specific behavior learning points (behaviors to be modeled) are shown in each film. Each film and the learning points are introduced by the plant manager. For example, from the film script for "Motivating the Poor Performer" (61):

> "NARRATOR: Hello, I'm Fred Harris, Plant Manger. In the film you are about to see you will find one of my very effective foremen talking to one of his workers about his performance. In their discussion the foreman will follow certain learning points:
>
> 1. Focus on the problem, not the employee.
> 2. Ask for his help and discuss his ideas on how to solve the problem.
> 3. Come to agreement on steps to be taken by each of you.
> 4. Plan a specific follow-up date."

Role-Play

The instruction for role-playing used by Goldstein and Sorcher (61) are quoted in full:

> "The role play employee should be called by the first name of the real employee during the role play. The trainer then instructs the role players to begin. It is the trainer's main responsibility at this point to be sure that "supervisor" both keeps role playing and follows the learning points. If the "supervisor" breaks role and begins making comments, explaining policy, etc., the trainers should firmly instruct him to stay in role. The trainer should positon himself near the board and point to each learning point in turn as the role play unfolds, being sure none are either missed or enacted out of order. If a "supervisor" feels the role play is not progressing well and wishes to start it over, this is appropriate. Do not permit him to step down at this point if at all possible. Also, do not permit interruptions of any kind from the group until the role play is completed.
>
> "(If possible) the role playing should be continued until <u>all</u> trainees have had an opportunity to participate (in either role) and preferably until most have had a chance to enact the supervisor role. Note that while the framework (learning points) of each role play in the series remains the same, the actual content can and should change from role play to role play. It is the problem as it actually occurs, or could occur, with the role-playing supervisor's <u>real</u> employees (or real individuals in his life space) which should be the content of the given role play."

Social Reinforcement

At the end of each role playing sessions, reinforcement procedure was begun. Reinforcement was given in the form of feedback or approval for utilizing the learning points modeled in the film. The trainer followed a sequence of questions designed to elicit comments from all participants. The role play "employee" was asked, "How did your boss make you feel? (Did you solve the problem, maintain self-esteem, maintain communication?) What are you likely to do now?" The observers were asked: "How well were the learning points followed? What specific behaviors did you like or dislike?" The role play "supervisor" was asked to "comment on your own enactment, the comments of others, and your specific anticipations regarding how, when and with whom you might attempt the learning points." The trainer commented in particular on the following of the learning points, and provided social reinforcement (praise, approval, encouragement) for close following. Comments by the experimenters were directed toward specific behaviors, and were not of a broad evaluative nature.

Transfer of Training

Goldstein and Sorcher (61) list four principles for maximizing transfer of training:

1. Provide the trainee with general principles or advance organizers.

2. Maximize response availability for providing high level of practice and over learning.

3. Maximize the number of identical elements.

4. Provide the trainee with on-the-job feedback, especially in the form of social reinforcement for correct job performance.

These principles of promoting transfer of training were implemented in the training techniques in the following ways:

- the film was made realistic for the work setting and relevant to the problems of particular concern to foremen as determined by a needs analysis questionnaire.

- the learning points provided organizers.

- the foremen's bosses supported and encouraged the application of Interaction Modeling teaching on the job. The managers in charge of the foreman first participated in Interaction Modeling training. The training was carried out with full support of the production manager.

- in role playing situations actual problems confronting supervisors were used.

- at the start of each meeting the participants were asked if they had an opportunity to test what they had seen and practiced during the previous week. Successful tryouts were praised and unsuccessful ones led to role playing and discussion to resolve the difficulty.

An Experimental Analysis of Interaction Modeling

An experiment designed to assess the relative contribution of various components of Interaction Modeling to behavior change was performed (86). The subjects (150 students in advanced psychology courses) were assigned to one of five treatments:

1. Modeling, behavioral rehearsal, and social reinforcement.

2. Modeling alone.

3. Behavioral rehearsal with reinforcement.

4. Modeling, behavioral rehearsal, social reinforcement. Control for pretest sensitization--no pretest given.

5. No treatment control group. Viewed unrelated film.

For the modeling, a five-minute film "Handling the Complaining Employee" (developed by Applied Learning Associates) (61) was used.

Subjects completed a 30 item paper-and-pencil test designed to measure their ability to respond to complaints on the basis of the learning points taught in the module "Handling the Complaining Employee." The pretest was completed by the subjects in groups 1, 2, 3, and 5. The 30-item test was again completed by all subjects as a post-test at the end of the session. The results are given in Table 4.

One significant effect was found--behavioral rehearsal with reinforcement when used alone and with modeling resulted in more learning than other treatments.

Can one conclude from this experiment that modeling does not contribute to training supervisors and can be eliminated from the method used in training supervisors? Note that in this investigation the behavior being changed was purely verbal paper-and-pencil test behavior (pick the best response to a complaint from a set of four) and not the interpersonal behavior trained by Interaction Modeling. Most important, according to the pretest scores the college subjects prior to any training already largely knew and accepted the principles of responding to complaints. (These are the procedures well known to psychologists and psychology students, e.g., avoid responding with hostility or defensiveness, recognize feelings, show understanding of viewpoint). In fact, after training, average scores only increased a few points, a significant but unimportant increase (see Table 4). The reviewer concludes that the investigation fails to provide an adequate test of the contribution of modeling to supervisory behavior.

Table 4

Result of Experimental Analysis of Interaction Modeling

Group	Pretest	Post-test
1. Modeling (film), rehearsal, reinforcement	122	127
2. Modeling (film)	116	119
3. Rehearsal, reinforcement	124	128
4. Modeling (film), rehearsal, reinforcement	-	122
5. Control (saw unrelated film)	122	122

NOTE: A perfect score would be 150 points or 5 points per item.

Validity Studies of Interaction Modeling

Several investigations have shown the effectiveness of Interaction Modeling in teaching supervisors interpersonal skills which they use on the job (56).

In a study for AT&T the skills of supervisors trained by Interaction Modeling were compared to those of an equivalent group of supervisors who did not have such training. Observers who did not know what training the supervisor had been given rated each supervisor's handling of a simulated problem discussion. Most (84%) of the trained supervisors were rated above average, but only one-third of the untrained supervisors were rated that high. A similar study performed at General Electric found that trained managers performed significantly better than untrained managers in handling interpersonal job problems.

Three investigations have shown that not only do supervisors learn the interpersonal skills, but that the training results in significant productivity increases from the work group they supervise (56).

Subordinate Imitation of Supervisors

In a study by Weiss (84) predictions were derived from social learning theory concerning which subordinates would be likely to imitate their bosses' behavior. The predictions were tested by data collected from 141 pairs of subordinates and supervisors in seven organizations. All subjects described their own leadership type and the subordinates described for their superiors their competence, their organizational success, and their reward power.

The results shown in Table 4 supported the social learning theory predictions. The subordinates who reported their bosses as high in competence and in organizational success were most likely to report having a leadership

style similar to that of their supervisors. Behavior similarity was determined by scoring the similarity between the leadership style reported by the subordinate and the style reported by the boss. However, when subjects were divided according to their reported self-esteem, the behavior similarity of those of low self-esteem were found to be related to perceived supervisor characteristics but not for those of high self-esteem (see Table 4). Self-esteem was shown to have a pronounced moderating effect on behavior similarity, as would be predicted from modeling experiments.

For the whole sample, perceived reward power was not related to behavior similarity. Reward power was defined in terms of control of external rewards such as pay and promotions. When subjects were divided according to their orientation to extrinsic or intrinsic rewards, a substantially increased correlation was found for perceived reward power and behavior similarity for those with higher orientation toward intrinsic rewards (r = .29). Thus, for the total sample, reward power did not seem to be a relevant model characteristic, but when the values of participants were taken into consideration, reward power correlated with similarity as predicted.

Table 5

Correlation Between Supervisor Characteristics and Behavior Similarity

Perceived Supervisor Characteristics	All Subjects (n = 141)	High Self-Esteem Subjects (n = 72)	Low Self-Esteem Subjects (n = 69)
Success	.29*	- .02	.48*
Competence	.22	- .10	.36*
Reward Power	.06	- .16	.16

*p <.05

CONCLUSIONS

Research on OJT and on social learning theory has been examined.

OJT is the most frequently used form of industrial training, but occurs most often in an unstructured form--without training plans and without trainer. Research has repeatedly demonstrated the greater training efficiency possible when teaching skilled jobs with structured OJT. Apprenticeship training is structured, but investigations show that the efficiency of the training is often reduced by a set of difficulties in managing this training.

Social learning theory has stimulated a number of investigations of the use of imitation for inducing therapeutic behavior changes and for training interpersonal skills. These investigations have documented repeatedly that using modeling as part of training for complex behavior results in increased effectiveness.

The industrial training literature describes the Four Step Method (prepare, present, apply, follow-up) as the model for arranging OJT. While imitation and social factors are mentioned as part of this training model, we found no investigations of the role of these social factors in OJT.

We failed to find any investigations applying social learning theory to the design of more efficient OJT. (Social learning theory has been successfully applied, however, to training of supervisors in interpersonal skills.) We believe that OJT presents a fertile field for applying the principles of social learning theory. We have generated a series of propositions about training from social learning theory. The propositions illustrate the possible future applications of social learning theory to on-the-job training.

Following are specific conclusions derived from the literature.

Social Learning Theory and Modeling

1. Film and/or videotape presentation of models for trainees to emulate has been shown to be effective in changing behavior. It has also been shown that the models should display "coping" behavior to be most effective. Therefore, videotape examples of behaviors that are deemed desirable could be used effectively whenever the need is evident that employee behavior requires changing. Such behavior may be either task oriented or attitudinal, such as bigoted behavior toward fellow employees. Narrative commentary accompanying the videotape is effective in highlighting specific aspects of the behavior modeled.

2. Success at performing a job depends on the physical/mental limitations of the trainee and on the visibility of essential cues. Efforts should be made to model performance in the environment most like that in which the trainee will perform. That is, the best situation or environment in which to display exemplary behavior is that which is identical to

or mimics closely the setting in which the trainee must perform. Thus, the appropriate contextual setting must be identified, and incorporated into the production of the videotape.

3. Models should be easy to copy, otherwise trainees may not attempt the effort to imitate. The same standards of performance should be exacted from the model as from the trainee.

4. The application of social learning theory to OJT requires, among other things, that trainees clearly observe the consequences of proper behavior. That is, the trainee should be able to observe that proper performance of the task carries with it explicit or implicit rewards, such as breaks, time off and achievement awards, for example.

5. Because modeling is an effective method for obtaining increased effectiveness in complex behaviors, technical training programs should be reviewed with the objective of incorporating modeling as an instructional technique. Reward structures need to be incorporated to facilitate the explicit modeling process. Evaluation programs should be implemented to ensure proper and effective inclusion of the methodology in the program.

Structuring On-The-Job Training (OJT)

6. When assessment of worker performance is obtained following a training program in which the performance of trainees is measured against objectively derived criteria, attitudes about the ability of members of a particular race, or other ethnic characteristics, can change radically. Therefore, structured OJT that embodies effective objective measurement of performance will result not only in improved productivity as a result of the workers' increased knowledge and skill in performing the job, but because the worker will have a job to do! That is, a foreman will more likely entrust the performance of a given task to a worker if he is confident the worker can perform it.

7. On-the-job training has been found to be highly effective as a mechanism for training workers who have become disenchanted with the formal classroom. But, it is also effective with successful classroom learners.

8. Structured OJT is "tailorable" to the needs of a particular company. Hence, training content that is not appropriate for one company can be ignored there, but utilized in a company where it is appropriate. Specifics about machine preventive maintenance can relate to the particular machine in use in a given plant for example, rather than to machines of a generic type. Likewise, the specific lubrication schedules required in a given plant can be the specific content of the OJT program there.

9. Structured training costs more to conduct than non-structured training. Because of this "front end" cost, smaller companies are less likely to invest in structured OJT than larger companies. Therefore, larger companies have lower costs for OJT than smaller ones. Because of this, a mechanism should be found whereby the costs of development and updating of structured OJT can be funded, and the products shared with all companies, large or small.

10. Although there is an apparent lower cost when unstructured OJT is employed (because no money is spent in developing the training), in fact the structured OJT results in reduced training time and other savings resulting from lowered spoilage of production materials. It would, therefore, appear that structured OJT should be employed whenever possible as it reduces training and materials costs.

11. Since workers who have been trained to do their jobs properly increase productivity, the training should be structured and evaluations of the training programs and those persons trained therein should be made.

Apprenticeship Program

12. On-the-job training as it is found in some apprenticeship programs could be improved by integrating "related" training with actual production tasks. (This is an application of the functional context notions, in which the theory supporting task performance is not taught until the need for the theory is evident from the task that must be performed.) Supervisors should examine related training materials to select that material which best supports the OJT work.

13. When journeymen are to serve as trainers in OJT situations, especially of apprentices, their own job descriptions should incorporate "training" as one of their duties. Otherwise, the training function will be perceived as "extra" duty for which they are not compensated.

14. It is evident that journeyman status should be achieved only after an apprentice has demonstrated ability to perform, not after merely having completed a fixed number of hours of service as an apprentice. The notion that time is the essential factor that exposes the apprentice to a sufficiently wide experience base to prepare him for journeyman status is not supported by facts. In practice, many apprentices are used as assistants by their trainers until the required hours are expended. Some apprentices are never given any opportunity to do the work that they must do as journeymen, so that they are unprepared for the work even though certified to perform it.

15. Apprenticeship training, while structured, is troubled by out-of-date materials and a high likelihood that apprentices will be assigned as "go fors," assisting journeymen, rather than in learning the techniques and skills of their trade. Accordingly, those most interested in maintaining a credible labor pool of journeymen from the apprentice stream should examine the programs from the perspective of updating related course materials, and installing performance check tests to assess progress that apprentices are making towards mastery of required skills.

IMPLICATIONS

From the literature surveyed, it seems evident that, although on-the-job training is the predominant method of training personnel in job-related skills, most such training is informal and left to supervisors and foremen to conduct as they deem appropriate. However, it is also evident that

"structured" on-the-job training is both more effective and more efficient than training which is not systematically planned and controlled.

"Structured" on-the-job training is carefully designed so that trainees learn all of the skills that have been identified as required for effective job performance. Trainers (foremen and supervisors) use schedules, guidance, and training materials that are specifically designed to assist them in providing trainees with required instruction and experience. What is more, it includes the use of controls to ensure adherence to training plans so that trainees' performance can be brought to mastery with a minimum of nonproductive time and effort.

Obviously, structured programs will be more expensive to plan and develop than informal training. On the other hand, the evidence indicates that higher initial costs can be more than offset by reductions in time required for employees to reach desired performance levels and for supervisors to spend in training their personnel, as well as by reductions in materials spoilage attributable to new employees while they are learning to perform jobs correctly.

The most significant feature of structured on-the-job training is management and control of programs by training experts rather than foremen or supervisors. Training personnel are responsible for identification of required job skills, design of training content and methods, control, and program management. Although foremen and supervisors conduct the actual training on the job, all activities are carefully planned, monitored, and evaluated by training personnel who are knowledgeable about the best ways for achieving maximum results. Thus, the programs that result should be both more effective and more efficient than the informal activities currently predominant in industry and government.

For small companies, staff resources for development of structured programs are not normally available and the expense of using outside resources, such as consultants, may be too great. However, it is possible to design structured programs and associated materials for jobs that are common to many companies or industries, e.g., lathe operator. Such programs would be applicable for use within many different companies, with only minor modifications to fit local conditions or requirements. This feature would make it feasible for standard programs to be developed by Federal or state agencies, trade associations, etc., and disseminated widely for use within whatever companies or organizations might derive benefit from them.

Social Learning Theory

It appears that Social Learning Theory concepts and the methods derived from them have considerable potential for application to structured on-the-job training. The 20 principles of training that were derived from Social Learning Theory and presented in this report are, in effect, guidelines for development of structured training programs. Programs which are designed to ensure adherence to these principles can be expected to provide highly effective training that would be appropriate for use in a wide range of industries and organizations.

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

Published reports on on-the-job training (OJT) in industry were summarized in Part I including:

Frequency of OJT and various forms of training in industry,
Advantages and disadvantages of OJT in industry,
Recurrent problems of apprenticeship training,
Characteristics of military OJT programs,
Results of investigations on different method of conducting OJT,
Federally funded OJT programs for disadvantaged workers,
The four step method for conducting OJT.

Information on social learning theory (Bandura) and its applications were reviewed in Part II. The principles of Bandura's social learning theory were outlined. A number of rules for conducting training more effectively were derived from social learning theory. Research on observational learning in making therapeutic behavior changes and in teaching interpersonal skills (e.g., counseling and interviewing) were reviewed. Applications of social learning theory to industry were examined.

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